ORIGINAL ARTICLE

COMPARISON OF NEGATIVE PRESSURE VACUUM THERAPY (NPWT) AND TIE OVER DRESSING IN HEALING SKIN GRAFTS

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Background: Negative pressure wound therapy (NPWT) accelerates wound healing by inducing growth factors, evaporating fluid, removing microorganisms, and improving microcirculation. Compared to it the traditional technique involves applying a dressing that is tied over and secured with nylon stitches commonly known as tie over dressing. Both the methods of graft fixing have their pros and cons therefore current study was designed to compare the efficacy of tie over dressing and NPWT methods for securing split thickness skin grafts and sheet grafts. **Methods:** A randomized control trial was conducted at tertiary care hospital of Karachi from July to December 2023. Participants who visited the department for grafting, fulfilled the inclusion criteria and given consent throughout the study duration were included in the study. The participants were selected by non-probability consecutive sampling technique and groups were allotted by sealed envelope method. Group 1 received tie over dressing and Group 2 received NPWT dressing. The wounds were evaluated after 5 days for tie over dressing and after 3 days for NPWT dressing. **Results:** The wound were assessed for outcome (healing and complications) after 14 days. The percentage of graft take identified as 11 (31.4%) participants of tie over dressing group and 28 (80%) participants of NPWT dressing material had more than 50% graft take however, remaining participants of both the group suffered the wound healing complications and delayed healing. The significant (p<0.05) differences were observed for graft loss, hematoma formation, and infection. However, 25 (71.4%) participants of Vac-NPWT faced no complication (p-value =0.001). No patient in either group had complete graft loss. **Conclusion:** NPWT dressing has superiority in preventing graft loss, hematoma formation, and infection over tie over dressing.

Keywords: Negative pressure vacuum therapy (NPWT); Tie over dressing; Skin grafts

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INTRODUCTION

Negative pressure wound therapy (NPWT) accelerates wound healing by inducing growth factors, evaporating fluid, removing microorganisms, and improving microcirculation.[1] The vacuum-assisted closure (VAC) device, which uses a computerized suction pump to apply negative pressure to an open cell polyurethane foam dressing sealed over a wound, is the current standard for NPWT.[2] Furthermore, because the VAC device moulds well to irregularly shaped wounds, it has been routinely employed to secure split thickness skin grafts (STSG) as an alternative to standard bolster dressings.[3] STSG has been secured with NPWT. Single case reports, brief case series, and retrospective studies have all been published describing the approach. It can be used for meshed or sheet grafts as well.[4]

Negative pressure wound therapy has been expanded to incorporate the VAC and wall suction systems by a variety of investigators since the original study utilizing a basic suction drain.[5] NPWT has been used on skin grafts over contour imperfections, flap donor sites, free flaps, Alloderm, fasciotomy sites, burns, chronic ulcers, and irradiation wounds.[6] To date, two small-scale randomized controlled trials have compared NPWT to foam dressing and conventional bolsters for anchoring skin grafts. Both investigations concluded that NPWT was at least as effective as standard bolster dressings.[7,8] In research conducted by Tang Q. *et al*., occlusive dressing and connected to wall suction (GSUC) method was documented equally effective as NPWT.[5]

Various authors have suggested methods for attaching full-thickness skin grafts. The traditional technique involves applying a dressing that is tied over and secured with nylon stitches commonly known as tie over dressing.[9] Tie-over dressings are mostly used in skin grafting procedures to secure the harvested skin to the recipient bed by delivering the proper amount of pressure.[10] The application of a conventional tie-over dressing technique can help to facilitate the take of a skin graft. Fixation can occasionally be insufficient in hard-to-reach areas, with no contact with the wound bed and uneven pressure applied to the graft. The

primary concern in this case is dead spaces where hematomas and seromas may form. In addition, the gauze is tough and sticky as it gets saturated with blood, which might hurt and harm the graft when it is removed.[11] Considering their reported findings and availability of resources at our institute the current study was designed to compare the efficacy of tie over dressing and NPWT methods for securing split thickness skin grafts and sheet grafts.

MATERIAL AND METHODS

A randomized control trial was conducted at tertiary care hospital of Karachi from July-December 2023. Participants who visited the department for grafting, fulfilled the inclusion criteria and given consent throughout the study duration were included in the study. All adult patients with post traumatic wounds, infected wounds as a complication to diabetes, wounds due to road traffic accidents (RTA) were included. Patients with wounds on face fingers and hands and who wished to not participate in the study were excluded. The participants were selected by non-probability consecutive sampling technique and groups were allotted by sealed envelope method. Group 1 received tie over dressing and Group 2 received NPWT dressing. The wounds were evaluated after 5 days for tie over dressing and after 3 days for NPWT dressing.

A power dermatome (Zimmer electrical dermatome) was used to harvest the graft from donor site, the area was lubricated with Normal Saline and surrounding skin was stretched during the procedure. Thickness of dermatome was set to 10/1000 of an inch and the dermatome was glided evenly on the skin with constant pressure. A skin graft mesher was used to mesh the graft with a ratio of 1:1.5 so the skin could spread over greater area. Vacuum assisted suction dressing (NPWT) was used to cover the recipient bed in one group while in other group tie over dressing was employed. In NPWT dressing a gauze was fluffed and placed over the graft on top of a paraffin gauze. The suction drain in placed between the gauze then it was secured with opposite dressing. The suction drain was attached to wall suction present in the ward. Continuous negative pressure was kept between 85–125 mm Hg. For tie over dressing, silk sutures were sutured at the edges of recipient area with SSG. A paraffin dressing and fluffed gauze were placed and the dressing was secured using silk sutures over it. The donor site wound was covered with alginate dressing and kept intact for 14 days. Healing was assessed as percentage surface area of graft take at 14 days. It was noted if the wound healing was less than 50 percent or more than 50 percent and complications such as hematoma, seroma and infection were noted

SPSS V.24 was used to analyse the data. T test was used to analyse the numerical data and categorical data was evaluated by chi square test. All analysis was performed at 95% confidence interval and *p*-value less than 0.05 was considered as significant.

RESULTS

During the study duration 82 patients were admitted to plastic surgery ward for grafting procedure however, considering the study inclusion and exclusion criteria, and to create a balance between both the groups n=70 patients were included in the study. As per scrutinizing technique groups were allotted. Table 1 depicts the demographic data of participants.

After the procedure was performed the wound were assessed for outcome (healing and complications) after 14 days. The percentage of graft take identified as 11 (31.4%) participants of tie over dressing group and 28 (80%) participants of NPWT dressing material had more than 50% graft take however, remaining participants of both the group suffered the wound healing complications and delayed healing (table 2).

The patients who received tie over dressing faced more complications when compared to the NPWT group. The significant ($p<0.05$) differences were observed for graft loss, hematoma formation, and infection. However, 25 (71.4%) participants of Vac-NPWT faced no complication (*p*-value =0.001) as shown in table 3. No patient in either group had complete graft loss.

Table-1: Demographic data of participants

Variable		N=70	Group 1 (n=35) Tie-over dressing	Group 2 (n=35) Vac-NPWT
Age (mean±SD)		49.81±5.63	46.23±4.78	48.32±3.17
Gender F (P)	Male	45 (64.28%)	24 (61.5%)	21 (60%)
	Female	25 (35.71%)	11 (31.5%)	14 (40%)
Reason for injury F (P)	Burn	19 (27.1%)	11 (31.4%)	8 (22.85%)
	RTA	45 (64.3%)	23 (65.71%)	22 (62.85%)
	Diabetic wounds	6 (8.6%)	1 (2.8%)	5 (14.2%)

Table-2: Percentage of graft take in both the group

Graft-take %	Group 1 (n=35) Tie-over dressing	Group 2 (n=35) Vac-NPWT	*p*-value
>50%	11 (31.4%)	28 (80%)	0.001
<50%	24 (68.6%)	7 (20%)	

Table-3: Outcome of the dressing techniques in both the groups after 14 days

Outcome	Group 1 (n=35) Tie-over dressing	Group 2 (n=35) Vac-NPWT	*p*-value
Partial (less than 50%) Graft Loss	16 (45.7%)	3 (8.5%)	0.041*
Hematoma	6 (17.14%)	1 (2.6%)	0.012*
Infection	9 (25.71%)	5 (14.3)	0.044*
Seroma	2 (5.7%)	1 (2.6%)	0.182
No complication	11 (31.4%)	28 (80%)	0.001*

DISCUSSION

A full-thickness skin graft requires sufficient pressure to take. In this regard, tie-over dressing is frequently used to secure free skin grafts. The main goal of tie-over dressings in skin grafting is to create proper pressure to secure the harvested skin to the recipient bed. According to Smith *et al*., a 30mmHg pressure is sufficient to secure a graft, at this pressure the arterial vascularization is not affected however venous vascularization may be compromised.[12,13] In the current study, tie over dressing was compared with NPWT to observe the outcomes including grafts loss, infection, hematoma and seroma formation. When compared to NPWT the outcomes of tie over dressing came out to be poor and grafts loss, infection, hematoma and seroma formation was noted (*p*-value <0.05) among the patients at the follow-up.

A simple tie over dressing has been associated with various complications including hematoma formation, seroma formation and, loss of graft takes. However, considering its limitations modifications has been done in this technique and to secure skin grafts new techniques have been introduced.[14,15] Furthermore, it has been reported that uneven distribution of pressure may be a cause behind development of these complications.[16] In a systematic review out of fifteen studies, the conclusion of eight studies supported the idea of not using tie over dressing as in their results they found that there was 80% graft loss in patients who received tie over dressing.[17] Compared to these results we also observed highest number (45.7%) of graft loss in tie over dressing group additionally we found that infection was the one of the commonest reasons behind the graft loss followed by hematoma formation in both the groups.

Compared to tie over dressing NPWT entails delivering negative pressure via a vacuum pump while maintaining a closed atmosphere. NPWT enhances granulation tissue development while decreasing oedema and bacterial burden which is thought to be the reason of less complications associated with this technique of securing grafts.[18,19] In the current study the same observations were explored and 80% of patients who had NPWT dressing didn't have complication (i.e., successful graft takes). In a study cohort, NPWT technique was assed as per requirement of wound or injury, the researchers employed various augmentations in simple NPWT however, in each case the results favoured the use of NPWT and they concluded that attempting this technique for full thickness skin grafts as well as split thickness skin grafts has similar outcome and least chances of complications.[20]

In a meta-analysis various clinical trials and cohort surveys were taken into account to identify the difference among complication between NPWT and conventional method (tie over dressing), The study evaluated 16 studies and compared their results to conclude the benefits of either technique. According to the findings they reported that the patients who received NPWT has, greater rate of graft take which is similar to the findings of our study. The greater graft take due to NPET is attributed to the negative pressure applied between the graft and the recipient area which continuously maintains the closeness of both the surfaces at constant pressure. However, the same study mentioned that there was no difference in infections between both the techniques which is not parallel to our study.[21]

In literature debate exits regarding the application of pressure on the skin grafts however, one school of thoughts favours this concept and attempt various techniques which employ pressure over the grafts to promote the healing. Contrary to this the other perception is application of pressure may reduce vascularization and compromise blood supply hence pressure should not be employed.[15,22,23] The results of our study favour the 2nd concept and endorse application of negative pressure to promote the wound healing and graft take. The small sample size was the limitation of the current study. Therefore, we suggest multicentred studies to generalize the results and provision of infrastructure (machinery setup, teaching sessions) to plastic surgery wards so that the patients may have best treatment options in their local setups this will increase the patient compliance and decrease the associated morbidities.

CONCLUSION

NPWT dressing has superiority in preventing graft loss, hematoma formation, and infection over tie over dressing.

Conflict of interest: The authors declare no conflict of interest

Ethical Approval: The study was approved from ERC of the study setting.

Limitations of study: availability of conventional VAC/NPWT in our setup

AUTHORS' CONTRIBUTION

FN: Conception, design, data collection, analysis, drafting, critical revision, final approval. RHJ: Conception, design, drafting, critical revision, final approval. DA: drafting, critical revision, final approval. BY: Data collection, analysis, critical revision, final approval. SN, AA: Analysis, drafting, critical revision, final approval.

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